# NextSTEP-2 Habitation

Completed Technology Project (2016 - 2022)

## Project Introduction

Through the public-private partnerships enabled by the Next Space Technologies for Exploration Partnerships - 2 (NextSTEP-2) Broad Agency Announcement, NASA has selected six U.S. companies to help advance the Journey to Mars by developing ground prototypes and concepts for a deep space habitat around the Moon. These companies are:

- Bigelow Aerospace of Las Vegas, NV
- Boeing of Pasadena, TX
- Lockheed Martin of Denver, CO
- Northrop Grumman of Dulles, VA
- Sierra Nevada Corporation's Space Systems of Louisville, CO
- NanoRacks of Webster, TX

This round of NextSTEP selections are part of a phased approach that will catalyze commercial investment in low-Earth orbit and lead to an operational deep space habitation capability for missions in the area of space near the moon, which will serve as the staging point for human lunar surface missions as well as a proving ground for Mars during the 2020s. These missions will demonstrate human, robotic and spacecraft operations in a true deep space environment that's still relatively close to Earth and validate technologies for the longer journey to Mars.

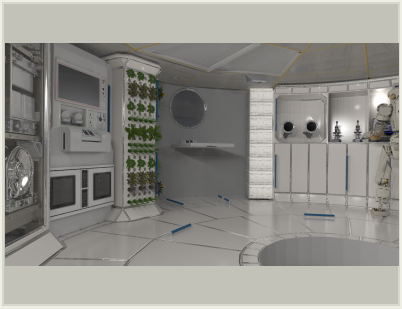
The ground prototypes will be used for three primary purposes: supporting integrated systems testing, human factors and operations testing, and to help define overall system functionality. These are important activities as they help define the design standards, common interfaces, and requirements while reducing risks for the final flight systems that will come after this phase. Additionally, each of the contractors shall identify and implement risk reduction activities associated with their concepts.

Rather than a ground demonstration, the NanoRacks contract included a feasibility study of using robots in space to transform an upper stage rocket into a habitable volume.

Following that study, the company is now planning and executing a small attached payload in space to perform a technology demonstrate to robotically cut metal in space. This effort can help NASA and industry create a key capability that may be needed for launch vehicle transformation.

Northrop Grumman's concept for their small habitat was selected to be the first habitable element of the Gateway and is currently under a new contract being managed by the Gateway Program Office at JSC.

Boeing, Bigelow, Lockheed Martin and Sierra Nevada have continued to refine their habitation concepts and have also assessed the changes required to provide habitation on the lunar surface as well as providing habitation for a 2-3 year mission to Mars.



Habitation Interior Concept

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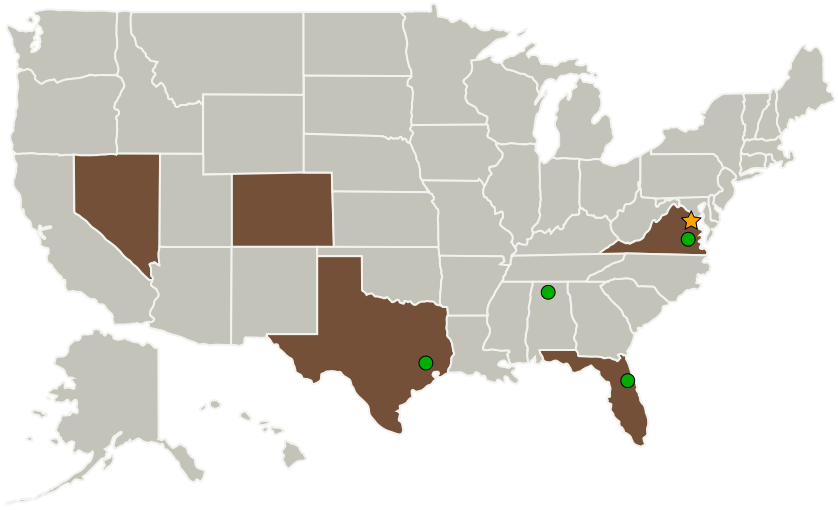
Boeing, Lockheed Martin and Sierra Nevada are focusing on risk reduction areas to mitigate habitat development risks. These activities include mass reduction activities and structural testing.

## Anticipated Benefits

The activities of these NextSTEP awards will inform the acquisition and deployment approach for the next phase of flight systems for deep space including important aspects, such as standards and interfaces, module configurations, and options for deployment using SLS, Orion, and commercial vehicles.

## Primary U.S. Work Locations and Key Partners



## Organizational Responsibility

**Responsible Mission Directorate:**

Exploration Systems Development Mission Directorate (ESDMD)

**Lead Center / Facility:**

NASA Headquarters (HQ)

**Responsible Program:**

Exploration Capabilities

## Project Management

**Program Director:**

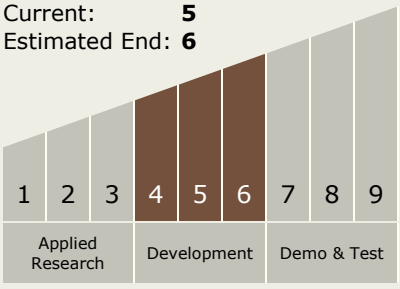
Christopher L Moore

**Project Managers:**

Douglas A Craig
Matthew W Rosenfelder

## Technology Maturity (TRL)

Start: **4**
Current: **5**
Estimated End: **6**



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| Organizations Performing Work | Role | Type | Location |
|---|---|---|---|
| ★NASA Headquarters(HQ) | Lead Organization | NASA Center | Washington, District of Columbia |
| Bigelow Aerospace(BA) | Supporting Organization | Industry | |
| ●Johnson Space Center(JSC) | Supporting Organization | NASA Center | Houston, Texas |
| ●Kennedy Space Center(KSC) | Supporting Organization | NASA Center | Kennedy Space Center, Florida |
| ●Langley Research Center(LaRC) | Supporting Organization | NASA Center | Hampton, Virginia |
| Lockheed Martin Space Systems(LMSS) | Supporting Organization | Industry | Sunnyvale, California |
| ●Marshall Space Flight Center(MSFC) | Supporting Organization | NASA Center | Huntsville, Alabama |
| Nanoracks, LLC | Supporting Organization | Industry | Alexandria, Virginia |
| Northrop Grumman Aerospace Systems(NGAS) | Supporting Organization | Industry | Redondo Beach, California |
| Sierra Nevada Corporation(SNC) | Supporting Organization | Industry<br>Women-Owned Small Business (WOSB) | Sparks, Nevada |
| The Boeing Company(Boeing) | Supporting Organization | Industry | Chicago, Illinois |

## Technology Areas

**Primary:**

- TX07 Exploration Destination Systems
  - TX07.2 Mission Infrastructure, Sustainability, and Supportability
    - TX07.2.1 Logistics Management

## Target Destinations

Earth, The Moon, Mars

## Supported Mission Type

Projected Mission (Pull)

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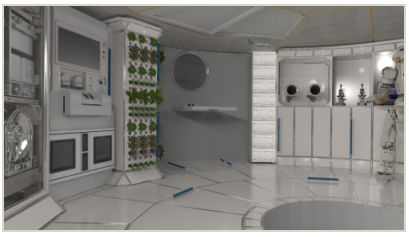
| Primary U.S. Work Locations | |
|---|---|
| Colorado | District of Columbia |
| Florida | Nevada |
| Texas | Virginia |

## Images



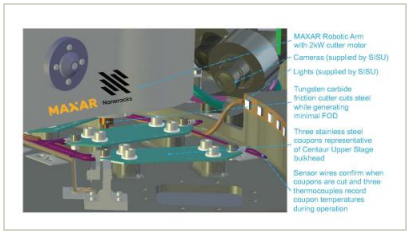
**A - Interior Concept**
Habitation Interior Concept
*(https://techport.nasa.gov/image/101097)*

**Bigelow Concept**
Concept image Bigelow's Gateway concept featuring their habitat design
*(https://techport.nasa.gov/image/101091)*

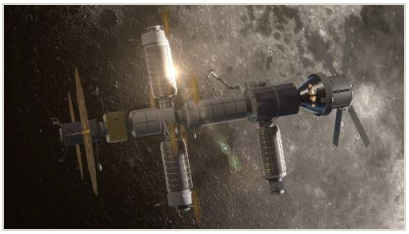
**Boeing Concept**
Concept image Boeing's Gateway concept featuring their habitat design
*(https://techport.nasa.gov/image/101094)*

**Lockheed Martin Concept**
Concept image of Lockheed Martin's Gateway concept featuring their habitat design
*(https://techport.nasa.gov/image/101092)*


**NanoRacks Concept**
Concept image of NanoRack's habitat concept docked to the International Space Station
*(https://techport.nasa.gov/image/101096)*




**Nanoracks robotically controlled cutting tool**
Depiction of Nanoracks robotically operated cutting tool to be tested in space.
*(https://techport.nasa.gov/image/101090)*



**Northrop Grumman**
Concept image of Northrop Grumman's Gateway concept featuring their habitat design *(https://techport.nasa.gov/image/101093)*

**Sierra Nevada Concept**
Concept image of Sierra Nevada's Gateway concept featuring their habitat design *(https://techport.nasa.gov/image/101095)*